Ultimate fuel analysis:
C __________
H __________
O __________
N __________
S __________
Ash __________
$H_2$0 __________

Trace metals:
Na __________
Va __________
K __________
etc [b] __________

Operating load __________

[a]Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.

[b]i.e., additional elements added for smoke suppression.

FIGURE 20–8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Turbine identification:
Manufacturer __________
Model, serial No. __________

Location:
Plant __________
City, State __________

Ambient temperature __________
Ambient pressure __________
Date __________
Test time: start __________
Test time: finish __________
Test operator name __________

Diluent instrument type __________
Serial No __________

NO_x instrument type __________
Serial No. __________

Sample point	Time, min	Diluent[a], %	NO_x a, ppm

[a]Average steady-state value from recorder or instrument readout.

6.2.3 After sampling the last point, conclude the test run by recording the final turbine operating parameters and by determining the zero and calibration drift, as follows:

Immediately following the test run at each load condition, or if adjustments are necessary for the measurement system during the tests, reintroduce the zero and mid-level calibration gases as described in Sections 4.3 and 4.4, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after the drift checks are made). Record the analyzers' responses on a form similar to Figure 20–3. If the drift values exceed the specified limits, the test run preceding the check is considered invalid and will be repeated following corrections to the measurement system. Alternatively, recalibrate the measurement system and recalculate the measurement data. Report the test results based on both the initial calibration and the recalibration data.

6.3 SO_2 Measurement. This test is conducted only at the 100 percent peak load condition. Determine SO_2 using Method 6, or equivalent, during the test. Select a minimum of six total points from those required for the NO_x measurements; use two points for each sample run. The sample time at each point shall be at least 10 minutes. Average the diluent readings taken during the NO_x test runs at sample points corresponding to the SO_2 traverse points (see Section 6.2.2) and use this average diluent concentration to correct the integrated SO_2 concentration obtained by Method 6 to 15 percent diluent (see Equation 20–1).

If the applicable regulation allows fuel sampling and analysis for fuel sulfur content to demonstrate compliance with sulfur emission unit, emission sampling with Method 6 is not required, provided the fuel sulfur content meets the limits of the regulation.

7. *Emission Calculations*

7.1 Moisture Correction. Measurement data used in most of these calculations must be on a dry basis. If measurements must be corrected to dry conditions, use the following equation:

$$C_d = \frac{C_w}{1 - B_{ws}} \qquad \text{Eq. 20-1}$$

where:

C_d=Pollutant or diluent concentration adjusted to dry conditions, ppm or percent.

C_w=Pollutant or diluent concentration measured under moist sample conditions, ppm or percent.

B_{ws}=Moisture content of sample gas as measured with Method 4, reference method, or other approved method, percent/100.

7.2 CO_2 Correction Factor. If pollutant concentrations are to be corrected to 15 percent O_2 and CO_2 concentration is measured in lieu of O_2 concentration measurement, a CO_2 correction factor is needed. Calculate the CO_2 correction factor as follows:

7.2.1 Calculate the fuel-specific F_0 value for the fuel burned during the test using values obtained from Method 19, Section 5.2, and the following equation.

$$F_o = \frac{0.209\ F_d}{F_c} \qquad \text{Eq. 20-2}$$

where:

F_O=Fuel factor based on the ratio of oxygen volume to the ultimate CO_2 volume produced by the fuel at zero percent excess air, dimensionless.

0.209=Fraction of air that is oxygen, percent/100.

F_d=Ratio of the volume of dry effluent gas to the gross calorific value of the fuel from Method 19, dsm^3/J (dscf/10^6 Btu).

F_c=Ratio of the volume of carbon dioxide produced to the gross calorific value of the fuel from Method 19, dsm^3/J (dscf^6 Btu).

7.2.2. Calculate the CO_2 correction factor for correcting measurement data to 15 percent oxygen, as follows:

$$X_{CO2} = \frac{5.9}{F_o} \qquad \text{Eq. 20-3}$$

where:

X_{CO2}=CO_2 Correction factor, percent.

5.9=20.9 percent $O_2 - 15$ percent O_2, the defined O_2 correction value, percent.

7.3 Correction of Pollutant Concentrations to 15 percent O_2. Calculate the NO_x and SO_2 gas concentrations adjusted to 15 percent O_2 using Equation 20–4 or 20–5, as appropriate. The correction to 15 percent O_2 is very sensitive to the accuracy of the O_2 or CO_2 concentration measurement. At the level of the analyzer drift specified in Section 3, the O_2 or CO_2 correction can exceed 5 percent at the concentration levels expected in gas turbine exhaust gases. Therefore, O_2 or CO_2 analyzer stability and careful calibration are necessary.

7.3.1 Correction of Pollutant Concentration Using O_2 Concentration. Calculate the O_2 corrected pollutant concentration, as follows:

$$C_{adj} = C_d \frac{5.9}{20.9 - \%O_2} \qquad \text{Eq. 20-4}$$

where:

C_{adj}=Pollutant concentration corrected to 15 percent O_2 ppm.

C_d=Pollutant concentration measured, dry basis, ppm.

$\%O_2$=Measured O_2 concentration dry basis, percent.

7.3.2 Correction of Pollutant Concentration Using CO_2 Concentration. Calculate the CO_2 corrected pollutant concentration, as follows:

$$C_{adj} = C_d \frac{X_{CO2}}{\%CO_2} \qquad \text{Eq. 20-5}$$

where:

$\%CO_2$=Measured CO_2 concentration measured, dry basis, percent.

7.4 Average Adjusted NO_x Concentration. Calculate the average adjusted NO_x concentration by summing the adjusted values for each sample point and dividing by the number of points for each run.

7.5 NO_x and SO_2 Emission Rate Calculations. The emission rates for NO_x and SO_2 in units of pollutant mass per quantity of heat input can be calculated using the pollutant and diluent concentrations and fuel-specific F-factors based on the fuel combustion characteristics. The measured concentrations of pollutant in units of parts per million by volume (ppm) must be converted to mass per unit volume concentration units for these calculations. Use the following table for such conversions:

CONVERSION FACTORS FOR CONCENTRATION

From	To	Multiply by
g/sm^3	ng/sm^3	10^9
mg/sm^3	ng/sm^3	10^6
lb/scf	ng/sm^3	1.602×10^{13}
ppm (SO_2)	ng/sm^3	2.660×10^6
ppm (NO_x)	ng/sm^3	1.912×10^6
ppm (SO_2)	lb/scf	1.660×10^{-7}
ppm (NO_x)	lb/scf	1.194×10^{-7}

7.5.1 Calculation of Emission Rate Using Oxygen Correction. Both the O_2 concentration and the pollutant concentration must be on a dry basis. Calculate the pollutant emission rate, as follows:

$$E = C_d F_d \frac{20.9}{20.9 - \%O_2} \qquad \text{Eq. 20-6}$$

where:

E=Mass emission rate of pollutant, ng/J (lb/10^6 Btu).

7.5.2 Calculation of Emission Rate Using Carbon Dioxide Correction. The CO_2 concentration and the pollutant concentration may be on either a dry basis or a wet basis, but both concentrations must be on the same basis for the calculations. Calculate the pollutant emission rate using Equation 20–7 or 20–8:

$$E = C_d F_c \frac{100}{\%CO_2} \qquad \text{Eq. 20-7}$$

$$E = C_w F_c \frac{100}{\%CO_{2w}} \qquad \text{Eq. 20-8}$$

where:

C_w=Pollutant concentration measured on a moist sample basis, ng/sm^3 (lb/scf).

$\%CO_{2w}$=Measured CO_2 concentration measured on a moist sample basis, percent.